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Smith, Kimberly K., PhD, RN, COL, AN USA

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The Geneva Foundation
917 Pacific Avenue, Suite 600
Tacoma, WA 98402

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14. ABSTRACT

Purpose: To determine effects of an in-hospital first-responder course on registered nurses' basic life support (BLS) skills retention, confidence, and anxiety. Design: A prospective blind, pre-test, post-test design was used. Participants were randomized into an experimental group that received pre-testing, a first responder course, and post-testing; and a control group, that received a lethal dysrhythmia course. The pre-test and post-test of both groups used identical methods. **Sample**: A convenience sample of Army active duty, Army reserve, and civilian RN's affiliated with Brooke Army Medical Center, San Antonio, Texas was used to enroll 108 with 99 completions. **Methods**: Both groups received pre-testing at 3-6 months after BLS course completion, a teaching intervention, and post-testing 6-9 months after interventions. Anxiety and confidence levels related to CPR/AED were measured. I**nstrumentation**: Instruments used for data collection were: Demographic Form, AHA BLS Critical Actions Checklist, Anxiety and Confidence Visual Analog Scales. Analysis: Statistical methods were: frequencies, measures of central tendency and dispersion, chi square statistics, correlation, ANOVA and logistic regression**. Findings**: Proficiency in CPR-AED skills was defined as passing the BLS Critical Actions Post-test. Registered nurses, who received a first responder course at six months, were not more proficient in CPR-AED skills than registered nurses who did not receive first responder training. When experimental and control groups were compared on the final BLS test, there was not a statistically significant difference despite 78.2% of the experimental group passing, compared to 63.6% of the Control group. **Implications for Nursing**: This study needs to be replicated with a larger sample size, greater control for exposure to incidental training outside of the experimental courses, and a better approach to assessing confidence and anxiety. Further research is needed in order to help identify the most appropriate education to facilitate retention of BLS skills.

15. SUBJECT TERMS
BLS training, nursing education, skills retention

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(Submit three hard copies and one electronic version of your abstract, report, & appendices)

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COL Kimberly K. Smith
Principal Investigator

[redacted]
Home Mailing Address

[redacted]
City, State, Zip Code

[redacted]
E-Mail Address

Principal Investigator Signature

NA
Mentor Name

Brooke Army Medical Center
Duty Station

3851 Roger Brooke Dr., Bldg. 3600
Work Mailing Address

Fort Sam Houston, TX 78234
Work City, State, Zip Code

Date

NA
Mentor's Signature and Date

LETTER OF GRATITUDE

The dedication and contribution of many individuals made this adventure in nursing research possible. A heartfelt thank you to all who participated, guided, and labored to complete this valuable contribution to nursing. I would like to acknowledge the following members of the Resuscitation Skills Grant team.

Current team:

COL Kimberly K. Smith, Principal Investigator
Dr. Darlene Gilcreast, Consultant
MAJ Elizabeth Mann, Associate Investigator
MAJ Amelia Smith, Associate Investigator
Ms. Karen Pierce, Project Director/ Associate Investigator
Ms. Dana Obuch, Research Assistant
Ms. Shannon Martin, Research Assistant

Contributing Members:

Dr. Steve Owen, Statistician
CPT Jason Williams, CPRTO Liaison
LTC Louis Stout, Past On-Site Principal Investigator
COL Della Stewart, Associate Investigator
MAJ Gayla Wilson, Associate Investigator

Kimberly K. Smith
COL
Primary Investigator

"I long to accomplish a great and noble task; but it is my chief duty and job to accomplish humble tasks as though they were great and noble. The world is moved along, not only by the aggregate of the tiny pushes of each honest worker."

-Helen Keller

II. TABLE OF CONTENTS

III. ABSTRACT -316 (300 max)

Purpose: To determine effects of an in-hospital first-responder course on registered nurses' basic life support (BLS) skills retention, confidence, and anxiety.

Design: A prospective blind, pre-test, post-test design was used. Participants were randomized into an experimental group that received pre-testing, a first responder course, and post-testing; and a control group, that received a lethal dysrhythmia course. The pre-test and post-test of both groups used identical methods.

Sample: A convenience sample of Army active duty, Army reserve, and civilian RN's affiliated with Brooke Army Medical Center, San Antonio, Texas was used to enroll 108 with 99 completions.

Methods: Both groups received pre-testing at 3-6 months after BLS course completion, a teaching intervention, and post-testing 6-9 months after interventions. Anxiety and confidence levels related to CPR/AED were measured.

Instrumentation: Instruments used for data collection were: Demographic Form, AHA BLS Critical Actions Checklist, Anxiety and Confidence Visual Analog Scales.

Analysis: Statistical methods were: frequencies, measures of central tendency and dispersion, chi square statistics, correlation, ANOVA and logistic regression**.**

Findings: Proficiency in CPR-AED skills was defined as passing the BLS Critical Actions Post-test. Registered nurses who received a first responder course at six months, were not more proficient in CPR-AED skills than registered nurses who did not receive first responder training. When experimental and control groups were compared on the final BLS test, there was not a statistically significant difference despite 78.2% of the experimental group passing, compared to 63.6% of the Control group.

Implications for Nursing: This study needs to be replicated with a larger sample size, greater control for exposure to incidental training outside of the experimental courses, and a better approach to assessing confidence and anxiety. Further research is needed in order to help identify the most appropriate education to facilitate retention of BLS skills.

IV. INTRODUCTION

" Resuscitation Training and BLS Skills Retention"

Some patients cared for in hospital facilities die each day from cardiac arrest. Nurses serve on the front-line of patient care, thus they are typically the first responder to a cardiac arrest. Research has shown that resuscitation skills degrade over a short period of time. Despite the fact that nurses re-certify their BLS skills every two years, current research on the retention of these skills in RNs shows that within 3 months, 27% of nurses are unable to pass BLS recertification. Even more astounding, within 9 months of a BLS course 66.7% of RNs are unable to pass BLS recertification.

Resuscitation skills training and retention has been a topic of discussion for many years. It is imperative that healthcare providers be equipped with the skills necessary for life support sustainment. This is especially true for providers working in healthcare facilities. Research has shown that life support skills degrade over time. In a completed study examining skills degradation performed at Brooke Army Medical Center, data showed that skills begin to degrade sharply between three and six months after training. Based on this information and the literature, our study was needed to help determine interventions that would reduce skills degradation and ensure clinical competence in a bedside Code Blue.

V. SCOPE OF THE STUDY

Specific Aims

The purpose of this research study was to test an intervention designed to improve basic life support (BLS) skills retention. Specific aims of this study were to:

1. Determine if a resuscitation course offered between three and six months of BLS certification would affect skills retention.

2. Determine if participation in a resuscitation course would improve the level of confidence and decrease the anxiety level experienced by participants relative to BLS skills, thereby reducing the current rate of failure.

There is limited information currently available regarding the best method of "just in time" training to address BLS skills degradation. Findings from this study will add to scientific body of knowledge and possibly offer a method to reduce skill degradation that will be feasible for military healthcare facilities.

Research Hypotheses

1. Registered nurses who receive a first responder course, at 12 months post BLS certification, will be more proficient in CPR-AED skills than registered nurses who do not receive first responder training.

2. Registered nurses who receive a first responder course will report, at six months post course, a higher confidence level in using CPR-AED skills than RN's who do not receive first responder training.

3. Registered nurses who receive a first responder course will report, at six months post course, lower anxiety levels in using CPR-AED skills than RN's who do not receive first responder training.

VI. RESEARCH PLAN

Conceptual Framework

The Criterion Referenced Instruction framework developed by Mager (1975), in-hospital chain of survival [American Heart Association, (AHA), 2000], and Knowles' theory of adult learning (1975) drove this study and served as a basis for the development of the intervention. The following principles are the underpinning for Mager's framework.

1. Instructional objectives are derived from job performance and reflect the competencies (knowledge/skills) that need to be learned.

2. Students study and practice only those skills not yet mastered to the level required by the objectives.

3. Students are given opportunities to practice each objective and obtain feedback about the quality of their performance.

4. Students should receive repeated practice in skills that are used often or are difficult to learn.

5. Students are free to sequence their own instruction within the constraints imposed by the pre-requisites and progress is controlled by their own competence (mastery of objective).

The Chain of Survival is a metaphor used to communicate the interdependency of a community's emergency response to cardiac arrest [International Liaison Committee on Resuscitation (ILCOR), 2000]. The "chain of survival" concept was introduced in 1992 and includes four links: (1) early access, (2) early CPR, (3) early defibrillation, and (4) early ACLS. Survival from cardiac arrest depends on a series of critical interventions within each one of these links (ILCOR, 2000). If there is a

weakness in the recognition of need, timing, or application of these critical interventions, survival and outcome will be poor. A “weak link” in the chain of survival can be devastating to the outcome of the cardiac or respiratory arrest victim.

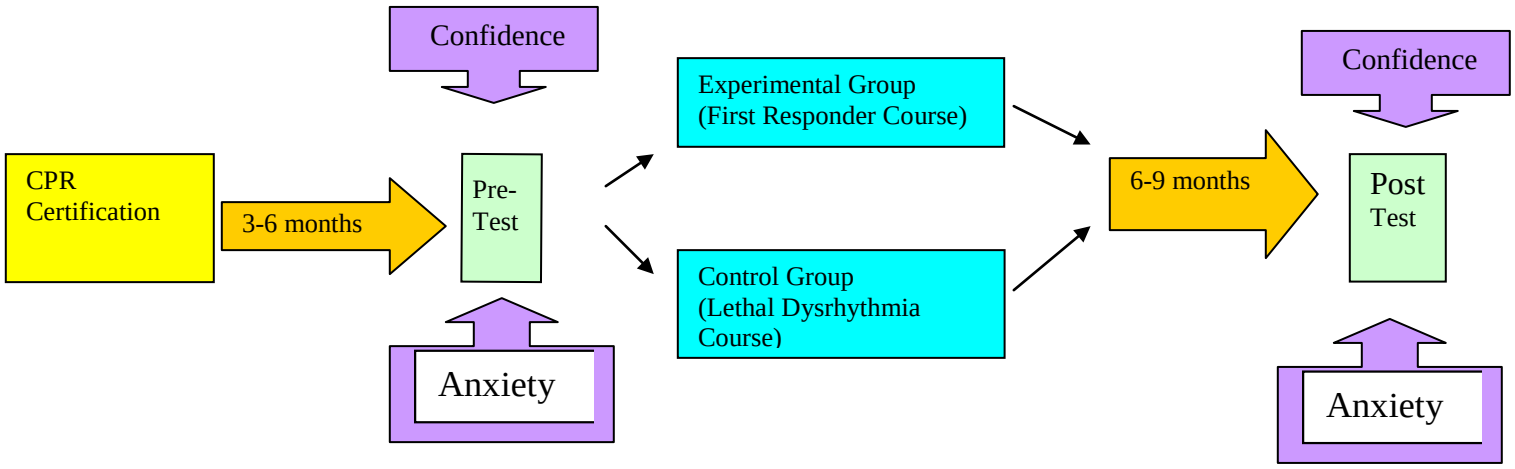
Knowles (1975) theory of adult learning (andragogy) emphasizes that adult learners are self-directed and expect to take responsibility for their own decisions to include learning. Adults learn best when given the opportunity to connect the new information with their life experiences. Assumptions underlying this theory are adults (1) need to know why it is necessary to learn something, (2) need to learn experientially, (3) approach learning as problem-solving, and (4) learn best when the topic is of immediate value (Knowles).

Design/ Methods

This research project used a prospective single-blind, pre-test, post-test, experimental design. This approach was chosen to test the effect of a first responder course on retention of CPR-AED skills. Participants were randomized into one of two groups. The experimental group received pre-testing, a first responder course and post-testing. The control group received pre-testing, an alternative treatment (a lethal dysrhythmia course), and post-testing. The control group was blinded to the fact that they were receiving an alternative treatment. The pre-test and post-test of both groups used the same methods.

The premise of this study was that skills degrade sharply within the 3 to 6 months following BLS certification training. Confidence level, anxiety level, and time interval influence skill retention. A resuscitation course intervention will improve skill retention at the12-month date following initial BLS certification. Participants in the First Responder Course will experience an increase in confidence level and a decrease in anxiety level as a result of their course participation. The following schema depicts the design of the study.

Figure 1. Schema for BLS-AED Skills Retention Study



Setting & Participants

The accessible sample included registered nurses working at Brooke Army Medical Center (BAMC). According to the personnel databases (Sept 2003) at BAMC, 723 registered nurses were employed, assigned, or trained at the medical center at the time of the study.

Of the 723 registered nurses who worked at or were affiliated with BAMC, 108 nurses enrolled in this study. The sample was drawn from a population of RNs who happened to be active duty and reserve Army nurses, civilian registered nurses, or contract agency registered nurses. There was no reason to believe there would be a difference between these groups of RNs in BLS role performance. SPSS 11.5 generated a table of random numbers for control and experimental groups. Participants were assigned equally to one of the two groups. All participants had been recertified in BLS within the previous three to six months.

Sampling Plan: Inclusion, Exclusion Criteria

Eligibility Criteria

Inclusion criteria mandated the individual complete the AHA or military training network BLS class 3-6 months prior to enrollment.

Inclusion Criteria.

1. Registered nurse assigned to BAMC or the 5501st U.S. Army Hospital

2. Current AHA / MTN BLS issued within the previous 3-6 months

Exclusion Criteria.

1. Not expected to relocate or PCS in less than 6 months

Recruitment

Registered nurses were contacted for voluntary participation in this study at BLS classes, through BLS class rosters, at unit level staff meetings, and through individual communication by phone, email, Department of Nursing Orientation, and in person. At BAMC, BLS classes occur every month. Prior to the study, the project director met with BAMC BLS instructors to explain the study. She asked to be notified of upcoming BLS classes and attended the opening session of each BLS class to introduce the study and its importance. She was available to answer any questions the nurses had about the study and explained the benefits of enrollment. If for some reason, the project director could not attend, class rosters were obtained for recruitment purposes.

Flyers and brochures were used as part of the recruitment efforts. Interested nurses were asked to complete a contact information form located on the brochure. Information requested included their name and phone number where they would like to be contacted. The project director scheduled appointment times, pre-testing, and training. The previously mentioned recruitment strategy was chosen because it was similar to the last study's recruitment strategy, which had proved effective.

Data Collection/Measurements

Inter-Rater Reliability

All testing was performed by the Project Director with the Research Assistant aiding. Since only one person was scoring the tests, there was no need for inter-rater reliability.

Initial Testing (Pre-test evaluation)

On the scheduled day of the pre-test evaluation, the volunteer reported to the classroom/simulated patient care environment. Upon arrival, the project director talked with participants about the informed consent. Each individual was asked to complete the inclusion/exclusion criteria worksheet, informed consent, and the demographic questionnaire. Once the demographic data sheet was completed, the individual was oriented to the testing environment. A brief Code Blue scenario consistent with those used by the AHA and BAMC BLS training was used by the evaluator for all participants to promote consistency of evaluation. The AHA CPR-AED Performance Criteria was used during the practice period. The participants were also asked to complete the confidence and anxiety instruments.

Training

After the volunteer completed the initial evaluation, he or she took the First Responder Course or the Lethal Dysrhythmia Course. It was estimated that this course would take approximately 60 minutes. The First Responder Course trained the individual to respond to a cardiac arrest in the hospital by requesting help, obtaining equipment, initiating CPR, and most importantly initiating AED/Defibrillation. The Lethal Dysrhythmia Course taught the individual to recognize dysrhythmias and the appropriate intervention. The total time commitment for the initial evaluation and the courses was approximately 1 hour.

Skills that were taught During the First Responder Course:

1. Help
2. Equipment
3. CPR
4. AED / Defibrillation – Lifepak 12

The First Responder Course focused on training registered nurses as first responders, who are confident and competent, to quickly initiate the chain of survival. The goals of the course mirrored those recommended by experts in resuscitation education (Chehardy, Dohery, Dracup, et al., 2001). Those goals were to (1) provide each participant with knowledge to recognize and the skills to respond to life threatening cardiopulmonary emergencies and (2) to improve clinical outcomes of patients who undergo resuscitation (Chehardy, et al., 2001).

The training plan and course outline for the First Responder Course used the AHA recommendations for Healthcare Provider BLS (CPR-AED) for Adult Victims. The corresponding checklist, AHA CPR-AED Performance Criteria was used to guide the content of the course, guide the participant through the steps of the in-hospital chain of survival, provide the participant with feedback of their performance, and introduce them to the requirements and expectations for testing.

The First Responder Course was designed to be a simplified, CPR-AED focused training event that maximizes hands on skills practice for the volunteer. Hands-on skills practice, feedback of performance, and multi-media reinforcement of BLS skills were all keys to maximizing the potential of skills retention (ILCOR, 2000). The goals of the course were to name the links in the in-hospital chain-of-survival, discuss the role of the first responder, perform one-person adult CPR-AED, and correctly operate the LifePak12 AED. A discussion of the chain of survival, a hands-on demonstration of the chain-of-survival, and a brief AHA video demonstrating the chain-of-survival was the core of the class content. The course instructions were followed by individual practice time for the experimental group. The project director evaluated performance and provided feedback using the AHA CPR-AED Performance Criteria checklist.

The Alternative Treatment - The Lethal Dysrhythmia Course.

This course reviewed ventricular tachycardia, ventricular fibrillation, and asystole interpretation and treatment. The content involved advanced cardiac life support skills. These skills were not evaluated as part of the specific aims of this research project. The alternative treatment is an attempt to minimize the Hawthorne effect. These participants were told that they were receiving a resuscitation-specific course pertinent to the purpose of this research project. Participants were asked to complete appropriate course evaluations after course instruction. No demo or practice time was done.

Final Testing (Post-test evaluation)

Post-test evaluation (final evaluation) period.

As a reminder, the project director or research assistant contacted participants one week before the scheduled post-testing appointment. On the scheduled day of the evaluation, the volunteer reported to the classroom/simulated patient care environment. Each individual was asked to complete the training update form to identify variables that could be responsible for the efficiency of the individual's resuscitative knowledge and skill level. The participant was re-oriented to the classroom/simulated patient care environment. The evaluator read the Code Blue scenario to place the individual in a situation that required the initiation of resuscitation actions. Each individual was evaluated with the BLS Critical Actions Checklist. The time required to complete the post-test evaluation was approximately 30 minutes. See Table 1 outlining procedure.

Table 1. Procedures and contrast of treatment of control and experimental groups

TASK	WHO	HOW	WHEN	CONTROL	EXPERIMENTAL
Recruit RNs for scheduled classes	PD or RA	Brochures, Flyers, Email, class rosters	3-6 mo. post BLS recert.	**X**	**X**
Pre-test BLS-AED Skills	PD	AHA Critical Action Checklist	3-6 mo. post BLS recert.	**X**	**X**
Pre-test Anxiety & Confidence	PD or RA	Anxiety/ Confidence Scales	During Scheduled Course Time	**X**	**X**
First Responder Course	PD	2 hr course	as scheduled		**X**
Lethal Dysrhythmia Course	PD	2 hr course	as scheduled	**X**	
Post-Test BLS-AED Skills	PD	AHA Critical Actions Checklist	9-12 mo. post BLS recert.	**X**	**X**
Post-Test Anxiety & Confidence	PD or RA	Anxiety/ Confidence Scales	9-12 mo. post BLS recert.	**X**	**X**

Instruments
Four instruments were used to collect data for this research project.

1. Demographic Form - The instrument was four pages in length and included only that information that was deemed necessary to adequately describe the sample. Items included age, gender, education level, duty assignment, specialty area, years experience and BLS certification and practice. [Reference to Example?]

2. AHA BLS Critical Actions Checklist included the following information:

a. All skills performance sheets used by the AHA were reviewed by the science subcommittees and the Science Product Development Panel to ensure scientific validity. (BLS Instructor Guide, p. 1-49). The evaluation tools were also reviewed by educational consultants to ensure clarity, reliability, and linkage between the core objectives and the evaluation tools (BLS Instructor Guide, p. 1-49). Checklists were designed to be measurable, objective, performance-based, and as simple as possible (BLS Instructor Guide, p. 1-49).

b. This evaluation tool allowed the evaluator to assess the individual's ability to conduct first responder CPR-AED skills. Hands on demonstration of the skills were required. Skills were assessed in sequential order as written on checklist. Skills were also assessed by the total time taken to initiate defibrillation or AED. All skills were completed using standard resuscitation equipment, identical to that used at BAMC. [Reference to Example?]

3. Anxiety Scale and Confidence Scale - The Visual Analog Scale
The Visual Analog Scale (VAS) is a widely used instrument to measure subjective feelings about various aspects of people's lives: fatigue, pain, anxiety, confidence,

dyspnea, etc. (Lee & Kieckhefer, 1989). Benefits of the VAS are that it is simple, easy to understand, and measures concepts in interval level data that otherwise would be difficult to assess. The VAS consists of a 100-millimeter line (drawn to an accuracy of .001 millimeter, either vertical or horizontal) that is marked at the end with 1/2-inch anchors perpendicular to the line (Cline, Herman, Shaw, & Morton, 1992).

Because the VAS is frequently used to measure whether a feeling is low or high, the most sensitive form of the scale is presented vertically, coinciding visually with the concept of height being vertical. Each end of the scale is marked with descriptive terms of the concept that is being measured, which are diametrically opposed; i.e. "NOT ANXIOUS at all" and "the MOST ANXIOUS I have ever been" (Cline, Herman, Shaw, & Morton, 1992). Subjects were asked to indicate the intensity of a subjective sensation at that exact moment by placing a line perpendicularly across the VAS line. The VAS is scored by measuring to the millimeter from the lowest anchor of the scale the point where the lines cross. The best way to measure the length is to create a template, drawn with the accuracy indicated above, marked with millimeter points for reference and use the same tool to measure every VAS in the study. This will eliminate error from reading the VAS with a ruler (Cline, Herman, Shaw, & Morton, 1992).

The VAS-Anxiety was found to be consistent with the Hamilton Rating Scale for Anxiety, the State-Trait Anxiety Inventory, and the Clinical Global Impression Scales (Bassi, Albizzati, Ferrarese, Frattola, Cesana, Piolti, et al, 1989). Lee and Kieckhefer (1989) report validity and reliability of the VAS must be evaluated in each situation assessed because one single-item of measurement is "unstable." Therefore, in the present study, the subjects' anxiety about their abilities to perform CPR and use the AED was validated by two separate VAS scales: 1) VAS-Anxiety and 2) VAS-Confidence. The poles for the nervousness scale was marked with the anchors: low-end anchor, "NOT AT ALL anxious;" high-end anchor, "THE MOST anxious I have ever been in my life." The poles for the confidence scale was marked: low-end anchor, "NOT AT ALL confident;" high-end anchor, "THE MOST confident I have ever been in my life" (Cline, Herman, Shaw, & Morton, 1992). The VAS-Confidence has demonstrated reliability between 0.64 and 0.77 (Grundy, 1993). [Reference to Example?]

4. Training Update Form – The training update form was used to track all relevant training, practices and activity between pre and post testing. [Reference to Example?]

VII. Data Analysis Table 1. Recruitment and Retention

Table 2. Recruitment and retention of participants

	Projected # 135		Actual # 99	
# subjects available	1022		1022	
# subjects contacted	1800		1800	
# subjects attrited	28		9	
# subjects refused			277	
# subjects consented			108	
Intervention/Control			58	50
# subjects enrolled				
Intervention/Control			58	50
# subjects dropped out				
Intervention/Control			4	5
# subjects completed intervention				
Intervention/Control			54	45

VIII. Results/Discussion

RESULTS

Preliminary Analyses

The statistical results are organized primarily around the research questions. However, preliminary work is presented first. This consists of biographic data comparisons between Experimental and Control groups. Although random assignment to groups was in place, there is no guarantee that such assignment will create equivalence on every single measured variable. Therefore, a series of tests were run to assess whether any initial group differences were statistically significant.

Random assignment of participants to groups assures equality over many trials. The typical researcher, though, uses a single randomization per study, and here, by chance alone, there may be imbalances in group status. But it is important to confront subjective differences with statistical tests to verify or deny whether randomization has operated properly.

The first apparent difference occurs with subsample sizes. The Control group contained 49 participants, and the Experimental group, 59. A binomial test, which asks whether these differences are significantly different from a 50-50 split, showed that the differences were well within what might be expected by chance (p = .387). Neither was there selective attrition between the two groups. The Control group had five dropouts; the Experimental group, four.

Random assignment to groups seemed to produce baseline differences in BLS skills, with the Control group pass rate of 30.6% versus the Experimental group's rate of 16.9%. However, a statistical test applied to these rates showed that the group difference was nonsignificant ($\chi 2[1\ df]= 2.81$, p = .094). The effect size (Cramèr's φ^2 =

.026) was also very small, showing that less than three percent of one group's variation in frequencies was explained by the other group's variation in frequencies.

In additional exploratory work focusing on initial group differences, various demographic data were analyzed by way of χ2 (for categorical variables) or independent groups *t*-tests (for measured variables). The rest of the narrative in this section focuses on some of the central biographic data. The entire collection of biographic data, partitioned by Experiment and Control groups, is given in Tables 1 through 30.

There was no difference in gender composition of the groups (χ2[1*df*] = 2.17, *p* = .104, φ^2 = .019). When the groups' age categories were compared (20-25, 26-35, 36-45, >45), there was no statistical difference (χ2[3*df*] = .652, *p* = .884, φ^2 = .006). Comparing the groups on actual age, rather than categories, was similarly nonsignificant (*t*[106] = .555, *p* = .580, effect size [r^2] = .005).

The groups were equally balanced in terms of workplace assignment (χ2[10*df*] = 4.505, *p* = .922, φ^2 = .042). And the two groups showed no differences in employment status (Active Duty, Reservist, Civil Service, Contract) (χ2[3*df*] = 4.84, *p* = .184, φ^2 = .044).

In a series of group comparisons with measured variables, there were no reliable differences in number of years at primary workplace (*t*[106] = .961, *p* = .339, r^2 = .009); years as an RN (*t*[106] = .390, *p* = .698, r^2 = .004); months since last BLS course (*t*[106] = .070, *p* = .944, r^2 = .00); years with a BLS card (*t*[106] = .172, *p* = .864, r^2 = .002); or number of BLS performed in the past two years (*t*[106] = 1.763, *p* = .081, r^2 = .016).

Tables 3-33 give descriptive summaries of the data in the narrative above, plus additional biographic data not mentioned. All variables' data are partitioned by Experimental and Control conditions. For convenience, the tables are grouped according to the form of data analyzed. The first Tables 3-32 refer to chi-square tests of categorical variables, and the concluding Table 33 is a collection of *t*-test results for continuous biographical data. Each categorical variable's table title also shows the *p*-value comparing Experimental and Control frequencies. For the *t*-test Table 33, *p*-values are aligned with each variable inside the table.

Cutting through the ramble of statistical tests and numbers, the summary is simple and straightforward. No biographic variable showed group differences. In other words, the randomization process worked exactly the way it was expected to.

Table 3. Gender by Group Crosstabulation (*p* = .14)

			1. Gender		
			Female	Male	Total
GroupNum	Control	Count	31	18	49
		% within GroupNum	63.3%	36.7%	100.0%
	Experimental	Count	45	14	59
		% within GroupNum	76.3%	23.7%	100.0%
Total		Count	76	32	108
		% within GroupNum	70.4%	29.6%	100.0%

Table 4. Age Group by Group Crosstabulation (*p* = .88)

			AgeGroup				
			20-25	26-35	36-45	>45	Total
GroupNum	Control	Count	4	8	16	21	49
		% within GroupNum	8.2%	16.3%	32.7%	42.9%	100.0%
	Experimental	Count	7	10	16	26	59
		% within GroupNum	11.9%	16.9%	27.1%	44.1%	100.0%
Total		Count	11	18	32	47	108
		% within GroupNum	10.2%	16.7%	29.6%	43.5%	100.0%

Table 5. Job by Group Crosstabulation (*p* = .18)

			3. Are You?				
			Active Duty	Reservist	Civil Service	Contract	Total
GroupNum	Control	Count	17	10	19	3	49
		% within Group Num	34.7%	20.4%	38.8%	6.1%	100.0%
	Experimental	Count	20	5	25	9	59
		% within Group Num	33.9%	8.5%	42.4%	15.3%	100.0%
Total		Count	37	15	44	12	108
		% within Group Num	34.3%	13.9%	40.7%	11.1%	100.0%

Table 6. Job by Group Crosstabulation (*p* = .97)

			WorkplaceCollapsed			
			Critical Care	Other	MedSurg	Total
GroupNum	Control	Count	9	28	12	49
		% within GroupNum	18.4%	57.1%	24.5%	100.0%
	Experimental	Count	12	33	14	59
		% within GroupNum	20.3%	55.9%	23.7%	100.0%
Total		Count	21	61	26	108
		% within GroupNum	19.4%	56.5%	24.1%	100.0%

Table 7. Work Area by Group Crosstabulation (*p* = .97)

			GroupNum		
			Control	Experimental	Total
4. Primary Area of Work	CCU	Count	9	12	21
		% within 4. Primary Area of Work	42.9%	57.1%	100.0%
	Intermed Care-Stepdown	Count	1	2	3
		% within 4. Primary Area of Work	33.3%	66.7%	100.0%
	Med-Surg	Count	12	14	26
		% within 4. Primary Area of Work	46.2%	53.8%	100.0%
	Ambulatory-Clinics	Count	8	8	16
		% within 4. Primary Area of Work	50.0%	50.0%	100.0%
	Specialty	Count	4	3	7
		% within 4. Primary Area of Work	57.1%	42.9%	100.0%
	ED	Count	4	4	8
		% within 4. Primary Area of Work	50.0%	50.0%	100.0%
	Mental Health	Count	0	1	1
		% within 4. Primary Area of Work	.0%	100.0%	100.0%
	Pediatrics	Count	0	1	1
		% within 4. Primary Area of Work	.0%	100.0%	100.0%
	Maternal-Infant	Count	0	2	2
		% within 4. Primary Area of Work	.0%	100.0%	100.0%
	Non-Nursing Healthcare	Count	1	2	3
		% within 4. Primary Area of Work	33.3%	66.7%	100.0%
	Other	Count	10	10	20
		% within 4. Primary Area of Work	50.0%	50.0%	100.0%
Total		Count	49	59	108
		% within 4. Primary Area of Work	45.4%	54.6%	100.0%

Table 8. Current Employment Status by Group Crosstabulation (*p* = .79)

			7. Current Employment Status				
			FT Nursing	PT Nursing	Non-Nursing Healthcare	Other	Total
GroupNum	Control	Count	47	0	1	1	49
		% within GroupNum	95.9%	.0%	2.0%	2.0%	100.0%
	Experimental	Count	55	1	2	1	59
		% within GroupNum	93.2%	1.7%	3.4%	1.7%	100.0%
Total		Count	102	1	3	2	108
		% within GroupNum	94.4%	.9%	2.8%	1.9%	100.0%

Table 9. Highest Professional Degree by Group Crosstabulation (*p* = .67)

			8. Highest Professional Degree				
			Diploma	AD	BSN	MN or MSN	Total
GroupNum	Control	Count	1	7	31	10	49
		% within GroupNum	2.0%	14.3%	63.3%	20.4%	100.0%
	Experimental	Count	1	10	41	7	59
		% within GroupNum	1.7%	16.9%	69.5%	11.9%	100.0%
Total		Count	2	17	72	17	108
		% within GroupNum	1.9%	15.7%	66.7%	15.7%	100.0%

Table 10. Have You Personally Defibrillated with AED? (*p* = .34)

			12. Personally Defibrillated w/AED		
			Yes	No	Total
GroupNum	Control	Count	7	42	49
		% within GroupNum	14.3%	85.7%	100.0%
	Experimental	Count	5	54	59
		% within GroupNum	8.5%	91.5%	100.0%
Total		Count	12	96	108
		% within GroupNum	11.1%	88.9%	100.0%

Table 11. Are You Comfortable using the AED? (*p* = .23)

			13. Comfortable Defibrillating w/AED		
			Yes	No	Total
GroupNum	Control	Count	36	13	49
		% within GroupNum	73.5%	26.5%	100.0%
	Experimental	Count	49	10	59
		% within GroupNum	83.1%	16.9%	100.0%
Total		Count	85	23	108
		% within GroupNum	78.7%	21.3%	100.0%

Table 12. Have You Personally Defibrillated with LifePak 12? (*p* = .61)

			14. Personally Defibrillated w/a LifePak 12		
			Yes	No	Total
GroupNum	Control	Count	12	37	49
		% within GroupNum	24.5%	75.5%	100.0%
	Experimental	Count	17	42	59
		% within GroupNum	28.8%	71.2%	100.0%
Total		Count	29	79	108
		% within GroupNum	26.9%	73.1%	100.0%

Table 13. Are You Comfortable using the LifePak 12? (*p* = .52)

			15. Comfortable defibillating w/a LifePak 12		
			Yes	No	Total
GroupNum	Control	Count	32	17	49
		% within GroupNum	65.3%	34.7%	100.0%
	Experimental	Count	35	24	59
		% within GroupNum	59.3%	40.7%	100.0%
Total		Count	67	41	108
		% within GroupNum	62.0%	38.0%	100.0%

Table 14. Do You Know How to Set Up a LifePak12? (*p* = .40)

			16. Know How to Set Up a LifePak 12		
			Yes	No	Total
GroupNum	Control	Count	35	14	49
		% within GroupNum	71.4%	28.6%	100.0%
	Experimental	Count	37	21	58
		% within GroupNum	63.8%	36.2%	100.0%
Total		Count	72	35	107
		% within GroupNum	67.3%	32.7%	100.0%

Table 15. Does BAMC's Code Protocol Allow RNs to Defibrillate with LifePak 12? (*p* = .95)

			17. Does BAMCs Code Protocol Allow RN LifePak 12			
			Yes	No	Don't Know	Total
GroupNum	Control	Count	19	3	27	49
		% within GroupNum	38.8%	6.1%	55.1%	100.0%
	Experimental	Count	22	3	34	59
		% within GroupNum	37.3%	5.1%	57.6%	100.0%
Total		Count	41	6	61	108
		% within GroupNum	38.0%	5.6%	56.5%	100.0%

Table 16. If You Were Comfortable using LifePak12, and BAMC Policy Allowed, Would You Defibrillate a Patient? (*p* = .85)

			18. If Comfortable and Allowed, Would You Defibrillate?		
			Yes	No	Total
GroupNum	Control	Count	47	2	49
		% within GroupNum	95.9%	4.1%	100.0%
	Experimental	Count	57	2	59
		% within GroupNum	96.6%	3.4%	100.0%
Total		Count	104	4	108
		% within GroupNum	96.3%	3.7%	100.0%

Table 17. Did You Receive Hands-on Training with the Portable AED in Your CPR/BLS Recertification Course? (*p* = .59)

			20. Hands-On Training w/AED		
			Yes	No	Total
GroupNum	Control	Count	36	13	49
		% within GroupNum	73.5%	26.5%	100.0%
	Experimental	Count	46	13	59
		% within GroupNum	78.0%	22.0%	100.0%
Total		Count	82	26	108
		% within GroupNum	75.9%	24.1%	100.0%

Table 18. Are You Currently a BLS Instructor? (*p* = .50)

			21. Currently a BLS Instructor		
			Yes	No	Total
GroupNum	Control	Count	3	46	49
		% within GroupNum	6.1%	93.9%	100.0%
	Experimental	Count	2	57	59
		% within GroupNum	3.4%	96.6%	100.0%
Total		Count	5	103	108
		% within GroupNum	4.6%	95.4%	100.0%

Table 19. If You Are Not Currently a BLS Instructor, Have You Ever Been in the Past? (*p* = .38)

			22. Have You Ever Been A BLS Instructor		
			Yes	No	Total
GroupNum	Control	Count	18	31	49
		% within GroupNum	36.7%	63.3%	100.0%
	Experimental	Count	17	42	59
		% within GroupNum	28.8%	71.2%	100.0%
Total		Count	35	73	108
		% within GroupNum	32.4%	67.6%	100.0%

Table 20. Have You Had a Train the Trainer Course in the Past 12 Months? (*p* = .85)

			24. Train the Trainer Course		
			Yes	No	Total
GroupNum	Control	Count	2	47	49
		% within GroupNum	4.1%	95.9%	100.0%
	Experimental	Count	2	57	59
		% within GroupNum	3.4%	96.6%	100.0%
Total		Count	4	104	108
		% within GroupNum	3.7%	96.3%	100.0%

Table 21. Have You Attended a Skills Fair with CPR/AED in the Past 12 Months? (*p* = .46)

			25. Skills fair with CPR-AED		
			Yes	No	Total
GroupNum	Control	Count	12	37	49
		% within GroupNum	24.5%	75.5%	100.0%
	Experimental	Count	11	48	59
		% within GroupNum	18.6%	81.4%	100.0%
Total		Count	23	85	108
		% within GroupNum	21.3%	78.7%	100.0%

Table 22. Have You Had LifePak 12 Training in the Past 12 Months? (*p* = .98)

			26. LifePak 12 Training		
			Yes	No	Total
GroupNum	Control	Count	19	30	49
		% within GroupNum	38.8%	61.2%	100.0%
	Experimental	Count	23	36	59
		% within GroupNum	39.0%	61.0%	100.0%
Total		Count	42	66	108
		% within GroupNum	38.9%	61.1%	100.0%

Table 23. Have You Had a Mock Code in the Past 12 Months? (*p* = .22)

			27. Mock Code		
			Yes	No	Total
GroupNum	Control	Count	20	29	49
		% within GroupNum	40.8%	59.2%	100.0%
	Experimental	Count	31	28	59
		% within GroupNum	52.5%	47.5%	100.0%
Total		Count	51	57	108
		% within GroupNum	47.2%	52.8%	100.0%

Table 24. Have You Taught a CPR or BLS Class in the Past 12 Months? (*p* = .52)

			28. Taught any CPR or BLS Class		
			Yes	No	Total
GroupNum	Control	Count	4	45	49
		% within GroupNum	8.2%	91.8%	100.0%
	Experimental	Count	3	56	59
		% within GroupNum	5.1%	94.9%	100.0%
Total		Count	7	101	108
		% within GroupNum	6.5%	93.5%	100.0%

Table 25. Have You Taught Any ACLS Class in the Past 12 Months? (*p* = .89)

			29. Taught any ACLS Class		
			Yes	No	Total
GroupNum	Control	Count	1	48	49
		% within GroupNum	2.0%	98.0%	100.0%
	Experimental	Count	1	58	59
		% within GroupNum	1.7%	98.3%	100.0%
Total		Count	2	106	108
		% within GroupNum	1.9%	98.1%	100.0%

Table 26. Have You Participated in a Code in the Past 12 Months? (*p* = .45)

			30. Participated in a code		
			Yes	No	Total
GroupNum	Control	Count	26	23	49
		% within GroupNum	53.1%	46.9%	100.0%
	Experimental	Count	27	32	59
		% within GroupNum	45.8%	54.2%	100.0%
Total		Count	53	55	108
		% within GroupNum	49.1%	50.9%	100.0%

Table 27. Have You Watched a Code in the Past 12 Months? (*p* = .45)

			31. Watched a Code		
			Yes	No	Total
GroupNum	Control	Count	26	23	49
		% within GroupNum	53.1%	46.9%	100.0%
	Experimental	Count	27	32	59
		% within GroupNum	45.8%	54.2%	100.0%
Total		Count	53	55	108
		% within GroupNum	49.1%	50.9%	100.0%

Table 28. Have You Used an AED in the Past 12 Months? (*p* = .73)

			32. Used an AED		
			Yes	No	Total
GroupNum	Control	Count	6	43	49
		% within GroupNum	12.2%	87.8%	100.0%
	Experimental	Count	6	53	59
		% within GroupNum	10.2%	89.8%	100.0%
Total		Count	12	96	108
		% within GroupNum	11.1%	88.9%	100.0%

Table 29. Have You Watched Any Videos on CPR or AED in the Past 12 Months? (*p* = .99)

			33. Watched any videos on CPR or AED		
			Yes	No	Total
GroupNum	Control	Count	34	15	49
		% within GroupNum	69.4%	30.6%	100.0%
	Experimental	Count	41	18	59
		% within GroupNum	69.5%	30.5%	100.0%
Total		Count	75	33	108
		% within GroupNum	69.4%	30.6%	100.0%

Table 30. Have You Studied CPR or AED from a Book in the Past 12 Months? (*p* = .84)

			34. Studied CPR or AED from a book		
			Yes	No	Total
GroupNum	Control	Count	34	15	49
		% within GroupNum	69.4%	30.6%	100.0%
	Experimental	Count	42	17	59
		% within GroupNum	71.2%	28.8%	100.0%
Total		Count	76	32	108
		% within GroupNum	70.4%	29.6%	100.0%

Table 31. Are You, or Have You Ever Been, an ACLS Instructor? (*p* = .70)

			39. Are you, or have you ever been, and ACLS Instructor?			
			No	Yes	Yes, but not current	Total
GroupNum	Control	Count	45	3	1	49
		% within GroupNum	91.8%	6.1%	2.0%	100.0%
	Experimental	Count	52	4	3	59
		% within GroupNum	88.1%	6.8%	5.1%	100.0%
Total		Count	97	7	4	108
		% within GroupNum	89.8%	6.5%	3.7%	100.0%

Table 32. T-Tests Comparing Groups on Continuous Variables

	GroupNum	N	Mean	Std. Deviation	p-Value
5. Years at Primary Work	Control	49	6.66	6.99	.34
	Experimental	59	5.46	6.01	
6. Years as an RN	Control	49	12.76	10.13	.70
	Experimental	59	13.61	12.19	
9. Time Since Last BLS Course (in Months)	Control	49	5.55	2.03	.94
	Experimental	59	5.58	1.69	
10. Years w/a BLS Card	Control	49	16.63	8.41	.84
	Experimental	59	16.95	10.37	
11. Performed BLS in past 2 years	Control	49	6.76	16.48	.08
	Experimental	59	2.71	5.72	
23. How Many Years Have You Taught BLS	Control	49	2.08	3.67	.25
	Experimental	57	1.35	2.78	
36. How Long Since Your Last ACLS Course (in	Control	49	7.90	17.82	.19
	Experimental	59	4.59	6.31	
37. How many Years w/an ACLS card?	Control	49	4.53	5.72	.99
	Experimental	59	4.55	6.43	
38. Times in the past 2 yrs. you performed ACLS	Control	49	6.31	16.45	.12
	Experimental	59	2.73	5.43	
40. If yes, how many years have you taught? (in	Control	49	.49	1.93	.91
	Experimental	58	.53	1.92	

Main Analyses

RQ#1: Registered nurses who receive a first responder course will, at six months, be more proficient in CPR-AED skills than registered nurses who do not receive first responder training.

Proficiency in CPR-AED skills was defined as passing the BLS Critical Actions Post-test. When Experimental and Control groups were compared on overall Pass/Fail rates on the final BLS test, there was not a statistical difference (see Table 33 below). Although 78.2% of the Experimental group passed, compared to 63.6% of the Control group, that was not enough to achieve significance ($\chi 2[1df] = 2.55$, $p = .11$). One suspects that the fairly small sample size made it more difficult to achieve statistical significance; but the effect size, Cramer's φ2, which is unrelated to sample size, was only .025. The conclusion is that group status was independent of pass rate.

Table 33. Crosstabulation of Group Status with BLS Skills Post-test Pass/Fail

			PostPassFail		
			.00 Fail	1.00 Pass	Total
GroupNum	1 Control	Count	16	28	44
		% within GroupNum	36.4%	63.6%	100.0%
	2 Experimental	Count	12	43	55
		% within GroupNum	21.8%	78.2%	100.0%
Total		Count	28	71	99
		% within GroupNum	28.3%	71.7%	100.0%

It is possible that total BLS scores masked important differences among the various 15 items of the BLS post-test. Several of the individual items had four response options: Pass, Fail, Unable to Evaluate Due to Not Activating AED, and Not Applicable. Because the last two response options are uninformative about a participant's skill, those options were treated as missing data. Using only Pass or Fail information for the individual items, chi-square tests showed no significant differences for most items. However, a single item was significant. Item10 (Attach electrode pads to the proper location) showed a superior pass rate for the Experimental group, 63%, compared to the Control group, 47%. The summary of these tests, each with one degree of freedom, is shown in Table 34 below. Following Table 35 are a series of crosstabulation tables, one for each item. It should be noted that for each group, Items 8, 9, and 11 showed very high failure rates (see Tables 42, 43, and 45, respectively). Beware, though, that many participants had missing data for item 8, so the resulting Pass/Fail rates are based on very small cell sizes.

Table 34. Item Level Chi-Square Tests Comparing Experimental and Control Pass Rates

BLS Item	$\chi 2$	*p*
1	0.07	.80
2	All passed	All passed
3	2.35	.13
4	3.46	.06
5	1.21	.27
6	0.03	.87
7	1.72	.19
8	0.05	.82
9	2.48	.12
10	4.21	.04
11	2.07	.15
12 (not given)	---	---
13	0.06	.80
14	0.12	.73
15	2.07	.82

Table 35. Item 1 Crosstabulation.

Crosstab

			Post@1. Assess Responsiveness 1. Assess Responsiveness		
			1 Pass	2 Fail	Total
GroupNum	1 Control	Count	40	2	42
		% within GroupNum	95.2%	4.8%	100.0%
	2 Experimental	Count	52	2	54
		% within GroupNum	96.3%	3.7%	100.0%
Total		Count	92	4	96
		% within GroupNum	95.8%	4.2%	100.0%

Table 36. Item 2 Crosstabulation.

Crosstab

			Post@2. Activate Emergency Response System 2. Activate Emergency Response System	
			1 Pass	Total
GroupNum	1 Control	Count	42	42
		% within GroupNum	100.0%	100.0%
	2 Experimental	Count	54	54
		% within GroupNum	100.0%	100.0%
Total		Count	96	96
		% within GroupNum	100.0%	100.0%

Table 37. Item 3 Crosstabulation.

Crosstab

			Post@3. OpenAirwayCheck Breathing 3. Open Airway/ Check Breathing		
			1 Pass	2 Fail	Total
GroupNum	1 Control	Count	37	5	42
		% within GroupNum	88.1%	11.9%	100.0%
	2 Experimental	Count	52	2	54
		% within GroupNum	96.3%	3.7%	100.0%
Total		Count	89	7	96
		% within GroupNum	92.7%	7.3%	100.0%

Table 38. Item 4 Crosstabulation.

Crosstab

			Post@4. Provide2Breaths 4. Provide 2 Breaths		
			1 Pass	2 Fail	Total
GroupNum	1 Control	Count	36	6	42
		% within GroupNum	85.7%	14.3%	100.0%
	2 Experimental	Count	52	2	54
		% within GroupNum	96.3%	3.7%	100.0%
Total		Count	88	8	96
		% within GroupNum	91.7%	8.3%	100.0%

Table 39. Item 5 Crosstabulation.

Crosstab

			Post@5.CheckPulse 5. Check Pulse		
			1 Pass	2 Fail	Total
GroupNum	1 Control	Count	41	1	42
		% within GroupNum	97.6%	2.4%	100.0%
	2 Experimental	Count	50	4	54
		% within GroupNum	92.6%	7.4%	100.0%
Total		Count	91	5	96
		% within GroupNum	94.8%	5.2%	100.0%

Table 40. Item 6 Crosstabulation.

Crosstab

			Post@6. BeginChest Compressions 6. Begin Chest Compressions		
			1 Pass	2 Fail	Total
GroupNum	1 Control	Count	40	1	41
		% within GroupNum	97.6%	2.4%	100.0%
	2 Experimental	Count	51	1	52
		% within GroupNum	98.1%	1.9%	100.0%
Total		Count	91	2	93
		% within GroupNum	97.8%	2.2%	100.0%

Table 41. Item 7 Crosstabulation.

Crosstab

			Post@7. StopsCPRwhen AEDarrives 7. Stops CPR when AED arrives		
			1 Pass	2 Fail	Total
GroupNum	1 Control	Count	27	11	38
		% within GroupNum	71.1%	28.9%	100.0%
	2 Experimental	Count	43	9	52
		% within GroupNum	82.7%	17.3%	100.0%
Total		Count	70	20	90
		% within GroupNum	77.8%	22.2%	100.0%

Table 42. Item 8 Crosstabulation.

Crosstab

			Post@8.ManualDefib 8. Manual Defib		
			1 Pass	2 Fail	Total
GroupNum	1 Control	Count	3	4	7
		% within GroupNum	42.9%	57.1%	100.0%
	2 Experimental	Count	2	2	4
		% within GroupNum	50.0%	50.0%	100.0%
Total		Count	5	6	11
		% within GroupNum	45.5%	54.5%	100.0%

Table 43. Item 9 Crosstabulation.

Crosstab

			Post@9. Placebackboard 9. Place back board		
			1 Pass	2 Fail	Total
GroupNum	1 Control	Count	3	38	41
		% within GroupNum	7.3%	92.7%	100.0%
	2 Experimental	Count	10	44	54
		% within GroupNum	18.5%	81.5%	100.0%
Total		Count	13	82	95
		% within GroupNum	13.7%	86.3%	100.0%

Table 44. Item 10 Crosstabulation.

Crosstab

			Post@10. Attachelectrodepads 10. Attach electrode pads		
			1 Pass	2 Fail	Total
GroupNum	1 Control	Count	36	5	41
		% within GroupNum	87.8%	12.2%	100.0%
	2 Experimental	Count	53	1	54
		% within GroupNum	98.1%	1.9%	100.0%
Total		Count	89	6	95
		% within GroupNum	93.7%	6.3%	100.0%

Table 45. Item 11 Crosstabulation.

Crosstab

			Post@11. Clearthevictim 11. Clear the victim		
			1 Pass	2 Fail	Total
GroupNum	1 Control	Count	17	19	36
		% within GroupNum	47.2%	52.8%	100.0%
	2 Experimental	Count	32	19	51
		% within GroupNum	62.7%	37.3%	100.0%
Total		Count	49	38	87
		% within GroupNum	56.3%	43.7%	100.0%

Table 46. Item 13 Crosstabulation.

Crosstab

			Post@13.PushSHOCK 13. Push SHOCK		
			1 Pass	2 Fail	Total
GroupNum	1 Control	Count	33	1	34
		% within GroupNum	97.1%	2.9%	100.0%
	2 Experimental	Count	47	1	48
		% within GroupNum	97.9%	2.1%	100.0%
Total		Count	80	2	82
		% within GroupNum	97.6%	2.4%	100.0%

Table 47. Item 14 Crosstabulation.

Crosstab

			Post@14. Collapsetoshockisless than3minutes 14. Collapse to shock is less than 3 minutes		
			1 Pass	2 Fail	Total
GroupNum	1 Control	Count	33	2	35
		% within GroupNum	94.3%	5.7%	100.0%
	2 Experimental	Count	47	2	49
		% within GroupNum	95.9%	4.1%	100.0%
Total		Count	80	4	84
		% within GroupNum	95.2%	4.8%	100.0%

Table 48. Item 15 Crosstabulation.

Crosstab

			Post@15. AEDarrivaltofirstshockislessthan90sec 15. AED arrival to first shock is less than 90 sec		
			1 Pass	2 Fail	Total
GroupNum	1 Control	Count	30	4	34
		% within GroupNum	88.2%	11.8%	100.0%
	2 Experimental	Count	44	5	49
		% within GroupNum	89.8%	10.2%	100.0%
Total		Count	74	9	83
		% within GroupNum	89.2%	10.8%	100.0%

Further Probes of Pass/Fail on BLS Posttest

The Post-test outcome measure was re-coded so that 1 = pass and 0 = fail. Then exploratory logistic regressions were arranged to predict success on the BLS posttest. Because logistic regression results are unstable with too many predictors and/or too few subjects, two separate models were run. The first logistic model contained group status (Control or Experimental), gender, age, years as RN, months since last BLS course, and four pretest Anxiety and Confidence scores. That overall model was nonsignificant (p = .25), and no individual predictor showed significance, although group status was close (p = .08).

The second logistic model contained pre-test pass/fail status, overall average participant course evaluation, post-test actual seconds of time to defibrillation, years with a BLS card, self-reported comfort in defibrillating with LifePak12, and whether the participant was currently a BLS instructor. As before, this full model failed (p = .15), and only a single individual predictor—posttest seconds to defibrillation—showed near significance (p = .06). In short, none of these potential predictors had any reliable relationship with the Pass/Fail outcome on the BLS Posttest.

Relationship of BLS Pretest Success to BLS Posttest Success

The data set was partitioned by group status (Control vs. Experimental), and chi-square analyses performed within each group to see whether pre-test pass/fail was related to post-test pass/fail. For the Control condition, $\chi 2(1df) = 2.6$, p = .11, and for the Experimental condition, $\chi 2(1df) = 0.7$, p = .40. Thus, participants' pre-test scores on BLS skills had no bearing on their post-test scores.

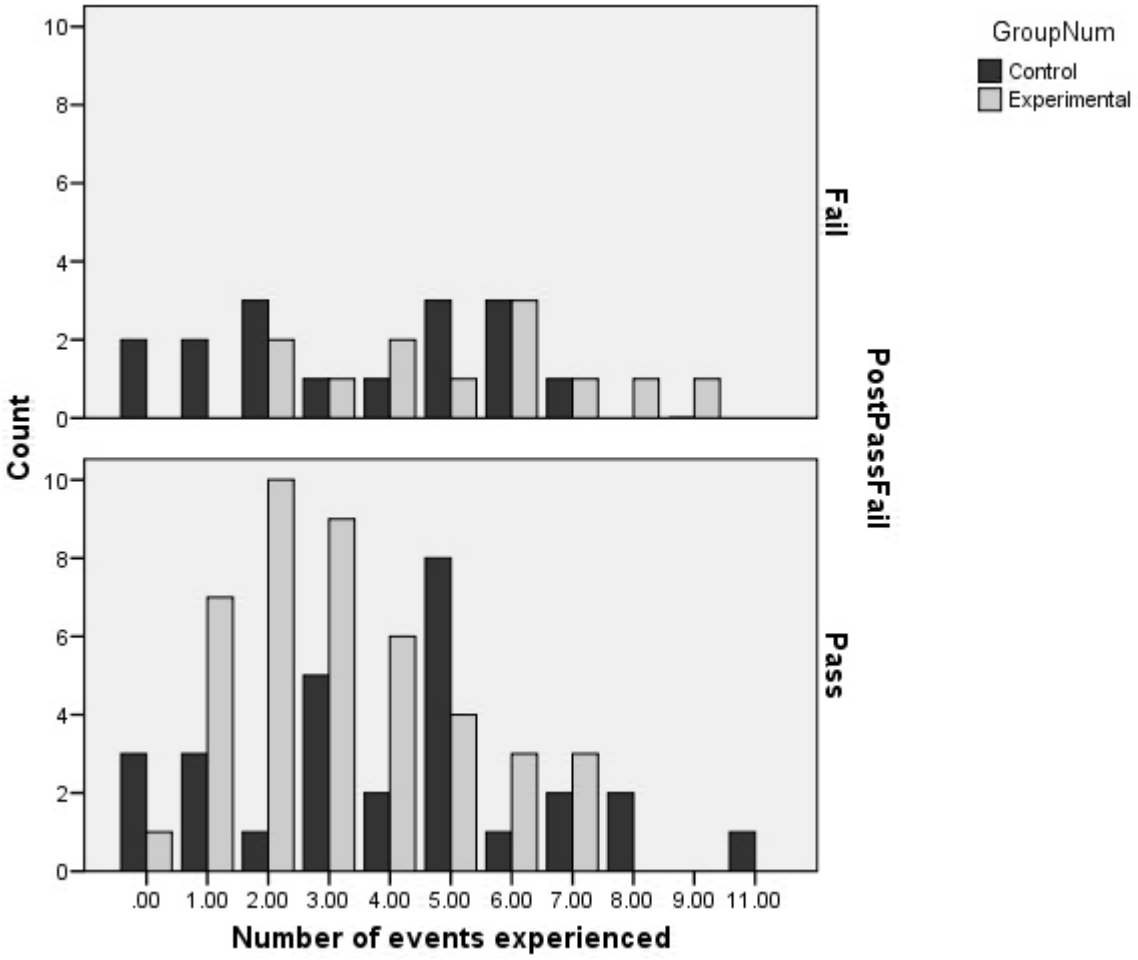
Relationship of Training Events to Pass/Fail of BLS Posttest

It seemed possible that previous training experiences might have something to do with Post-test BLS Skills success. To probe this idea, a hierarchical logistic regression model was developed. In the first stage, two main effects— group status (Control vs. Experimental) and total number of previous training events were entered

into the model. In the next stage, the interaction of group status and number of previous events was entered. The interaction answers the question: Does passing the skills test depend on ***both*** group status and amount of previous training? In such a model, the interaction is inspected first. If it is significant, main effects are incomplete explanations, and are thus ignored. If the interaction is not significant, then main effects are assessed.

In this model, the group x previous training interaction was significant (p = .008). Odds ratios are virtually impossible to interpret for interaction terms, so instead we study the interaction pattern with clustered bar graphs, shown in Figure 2 below.

Figure 2. *Clustered Bar Graphs of the Group x Previous Training Interaction.*



There are a lot of data points represented in the figure, but two trends appear. First, consider the top chart, which represents persons failing the exam. Note that those in Control condition (black bars) who failed the post-test, also tended to have ***less*** previous training (range = 0 to 7 events), and the Experimental participants who failed (grey bars) tended to have ***more*** previous training (range = 2 to 11). Second, in the bottom chart showing only those who passed the post-test, the Experimental group tended to have ***less*** previous training. One implication is that the Experimental group's intervention may have compensated for less previous training.

Additional self-selected training also occurred during the intervention period, and the number of episodes was again collected, this time, right before the final BLS skills test. Another logistic regression was arranged, parallel to the first, except that the main effect was now later training experiences, and the interaction term was group status x later training. This time, neither the interaction (p = .64), nor either main effect was significant (group, p = .11; later training, p = .44). Thus, additional training during the intervention period did not predict success on the final BLS skills test.

Relationship of Group Status with Observed Time to Defibrillate on BLS Test

The first 15 items on the BLS test were scored (generally) as pass/fail. The last item, though, was a continuous variable—the number of seconds a participant took for actual defibrillation. Shorter times predict better survival outcomes. The time to defibrillation was assessed at both pre-test and post-test. Thus, an additional analysis involved pre-to-post change in defibrillation time, within each group. For the Control group, a correlated *t*-test showed that their change (mean pre-test = 75.4s, mean post-test = 86.1s) was nonsignificant (t[42df] = -.85, p = .40). Neither was the Experimental group's change significant, with mean pre-test = 90.8s, mean post-test = 97.5s (t[54df] = -.56, p = .58).

These two within-group analyses do not address the question of whether the groups changed differently. To answer this, a raw change score was created by subtracting pre-test scores from post-test scores, and then running an independent groups *t*-test on the change score. The two groups' change scores seemed different, 11.1s for Control and 6.7 for Experimental. However, the apparent difference in change scores was dwarfed by the within-group variation (Control standard deviation = 85.5s; Experimental, 88.8s). Thus the *t*-test showed nonsignificance (t[96df] = .26, p = .81). In summary, there were no differences in time to defibrillate between Experimental and Control groups.

RQ#2: Registered nurses who receive a first responder course will report, at six months post-course, a higher confidence level in using CPR-AED skills than RNs who do not receive first responder training.

RQ#3: Registered nurses who receive a first responder course will report, at six months post-course, lower anxiety levels in using CPR-AED skills than RNs who do not receive first responder training.

Because of the similarity in measurement and content, these two research questions are grouped together. The focus here is on four outcome measures, each using a single 10mm visual analog response scale: Confidence in CPR, Confidence in AED, Anxiety about CPR, and Anxiety about AED. Table 47 shows each group's average scores at both Pre-test and Post-test. It also summarizes statistical comparisons for each measure. The *p*-values on the Pre-test measures were all nonsignificant, which should be expected because of random assignment to group. But the Post-test *p*-values are also nonsignificant, which means that the intervention neither boosted confidence nor lowered anxiety among participants.

Table 49. Comparison of Mean Scores by Group for Anxiety and Confidence Scales (Note: 0 – 10 = lowest to highest)

Prettest

	Control	*Experimental*	*p*
Anxiety AED	5.4	5.5	.98
Anxiety CPR	4.4	5.0	.27
Confidence AED	5.0	4.9	.81
Confidence CPR	6.1	6.1	.95

Posttest

	Control	*Experimental*	*p*
Anxiety AED	4.4	4.1	.59
Anxiety CPR	3.5	3.8	.63
Confidence AED	6.5	6.2	.58
Confidence CPR	7.0	6.8	.62

We created a further probe of the relationship of baseline Anxiety (both AED and CPR) and Confidence (both AED and CPR) with post-intervention pass/fail scores. For all four baseline measures, 3-way splits were used to group participants into High, Medium, and Low groups. This produced subgroups ranging closely in size from 35 to 37. Then, a series of $\chi 2$ analyses were arranged to compare (for example) Anxiety-AED group with post-intervention pass/fail scores. These $\chi 2$ analyses were done separately by Control and Experimental group.

In no instance did High/Medium/Low baseline category predict BLS performance. An example crosstabulation is shown in Table 50 for the Experimental participants grouped on Anxiety-AED. Although one cell looks unusual (medium Anxiety group who failed), it has only two cases. The $\chi 2$ for Table 50 data, based on all six cells simultaneously, failed to show significant variation ($\chi 2[2df] = 1.98$, $p = .37$). In all, the *p*-values for the Control group ranged from .47 to .83; and for the Experimental group, .34 to .61. Thus, baseline anxiety and confidence groupings were unrelated to post-intervention pass/fail performance on the BLS skills measure.

Table 50. Example Crosstabulation for Experimental Group Pretest Anxiety Levels by Posttest Pass/Fail

				PostPassFail		
GroupNum				.00 Fail	1.00 Pass	Total
2 Experimental	PreAnxAedCat threeway split	1.00 Low	Count	5	14	19
			% within PreAnxAed Cat threeway split	26.3%	73.7%	100.0%
		2.00 Medium	Count	2	16	18
			% within PreAnxAed Cat threeway split	11.1%	88.9%	100.0%
		3.00 High	Count	5	12	17
			% within PreAnxAed Cat threeway split	29.4%	70.6%	100.0%
	Total		Count	12	42	54
			% within PreAnxAed Cat threeway split	22.2%	77.8%	100.0%

We wondered whether pre-to-post Anxiety and Confidence scores would depend on whether participants were in the Control or Experimental group. The conventional way to assess that question is with a 2 (group) x 2 (occasion) repeated measures ANOVA. However, the ANOVA approach is complex, since it produces three significance tests (two main effects and an interaction), when it is only the interaction effect that merits attention. It is further complicated because the ANOVA interaction, assessing variation among four cell means, requires post hoc comparisons. However, the interaction effect is greatly simplified by creating raw change scores (i.e., Post-test score minus Pre-test score) and then performing an independent groups *t*-test on the change scores. This *t*-test is the mathematical equivalent of the ANOVA interaction, and no further post hoc probes are required. The *t*-test answers the essential question: Did the two groups change differently over time?

With our data, the answer is No. With each outcome measure, the two groups showed no statistical difference in pre-to-post change. For Anxiety about AED, $t_{(96)}$ = .36, p = .72; Anxiety about CPR, $t_{(97)}$ = .46, p = .65; Confidence about AED, $t_{(97)}$ = .07, p = .95; and Confidence about CPR, $t_{(96)}$ = .81, p = .42. In short, compared to the Control condition, the intervention produced no observable change in either anxiety or confidence about these BLS skills.

Reliability Estimation of Confidence and Anxiety Visual Analog Scales

Calculation of classic reliability estimates (e.g., Cronbach's coefficient alpha) require two or more items that belong to the same dimension. But the Confidence and Anxiety measures, both pre-test and post-test, consisted of a single item, a 10-mm

scale where respondents marked their perceived confidence or anxiety about CPR or using the LifePak 12 for defibrillation. However, another version of reliability coefficient is possible when there are repeated measurements. This form of reliability is known as test-retest, or stability, coefficients. Stability estimates are simple correlations between scores from one measurement occasion and scores from a second occasion. Whereas coefficient alpha estimates the proportion of consistent variation among a group of items, the stability coefficient estimates the proportion of score variation that remains consistent from one occasion to the next.

As usual, results are partitioned by Experimental and Control groups. Table 51 below shows stability estimates, within each group, for the four Anxiety and Confidence measures.

Table 51. Anxiety and Confidence Stability Coefficients within Group.

	Group	
Measure	Control	Experimental
Anxiety-AED	.38	.36
Anxiety-CPR	.80	.85
Confidence-AED	.25	.23
Confidence-CPR	.75	.76

There are several summary points from this table. First, for each measure, Control and Experimental coefficients are very similar. This is a positive finding, meaning that stability estimates are not conditioned on which group is being studied. Second, the two measures dealing with CPR show satisfactory stability estimates, in the .70s and .80s. And finally, measurements about AED are unstable over time. Data from both the Anxiety and Confidence scales show substandard coefficients. Because these coefficients represent proportions of consistent variance, the interpretation is straightforward. For example, the Control group's Confidence-AED coefficient of .25 means that 75% of the score variation is inconsistent from one occasion to the next. That suggests that the scores are extremely unstable. The problem is not that anxiety or confidence are like moods, shifting and shimmying over time, and therefore not expected to be durable. Obviously, the anxiety and confidence measures of CPR have no problems with stability over time.

Restriction of range is one aspect of data that shrinks correlations. If most participants score near the ceiling (or near the floor), the correlation becomes smaller. But a quick look at the data distributions in Tables 52 and 53 show no restriction of score ranges. Below are summaries of the anxiety measures, followed by the confidence measures. With a 10-point scale, average Anxiety scores of 3.5 to 5.5 are closer to midrange than to the ends of the scale.

Table 52. Summary Statistics for Anxiety Measures within Group.

GroupNum		PreAnxiety AED Anxiety AED	PostAnxiety AED Anxiety AED	PreAnxiety CPR Anxiety CPR	PostAnxiety CPR Anxiety CPR
1 Control	Mean	5.44	4.37	4.41	3.54
	N	48	44	49	44
	Std. Deviation	2.60	2.59	2.65	2.56
2 Experimental	Mean	5.45	4.09	4.98	3.79
	N	58	55	59	55
	Std. Deviation	2.43	2.47	2.66	2.42

The Confidence summaries, in Table 53, also show average values near the scales' midpoints. So restriction of range is not to be blamed for the AED scales' instability over time. Other hypotheses are speculative, but one possibility is that participants were simply not very good at assessing their perceived anxiety about using the LifePak 12 for defibrillation. Poor self-appraisal can result in hazardous guesses about anxiety, and when guesses from one occasion are correlated with guesses from a later occasion, the correlation is bound to be low. It is important to remember, though, that the better reliability of the Confidence scales did not improve their predictive validity with Pass/Fail outcomes on the BLS final test. No Anxiety or Confidence scores had any relationship with Pass/Fail scores.

Table 53. Summary Statistics for Confidence Measures within Group.

GroupNum		Pre Confidence AED Confidence AED	Post Confidence AED Confidence AED	Pre Confidence CPR Confidence CPR	Post Confidence CPR Confidence CPR
1 Control	Mean	4.99	6.46	6.13	6.98
	N	49	44	48	44
	Std. Deviation	2.92	2.18	2.51	2.29
2 Experimental	Mean	4.86	6.21	6.11	6.75
	N	59	55	59	55
	Std. Deviation	2.63	2.30	2.36	2.31

Additional Group Comparisons

All participants completed resuscitation training course evaluation forms, which consisted of nine statements. The response options used the conventional 5-point Likert format, where respondents show their endorsement of a statement between Strongly Agree (= 5) and Strongly Disagree (= 1). Undecided (= 3) is the midpoint of the response format. Table 54 summarizes the evaluation data. Four of the items, plus the overall average, show statistical significance ($p \leq .05$), in each case favoring the Experimental group. Note, though, that both groups strongly endorsed each item, so there was general satisfaction all around.

Table 54. Summary of Participant Evaluation Data

	GroupNum	N	Mean	Std. Deviation	p-Value
I learned something new in this course	Control	40	4.25	.81	.03
	Experimental	55	4.56	.57	
The physical environment was conducive to learning	Control	40	4.78	.48	.68
	Experimental	55	4.82	.51	
Presenter was knowledg-eable on the	Control	40	4.90	.30	.41
	Experimental	55	4.95	.23	
Teaching strategies were effective	Control	40	4.75	.44	.04
	Experimental	54	4.91	.29	
Teaching materials were effective	Control	40	4.60	.67	.02
	Experimental	55	4.85	.36	
This course was a satisfying learning	Control	40	4.65	.48	.01
	Experimental	55	4.89	.37	
The length of the course was reasonable	Control	40	4.75	.49	.15
	Experimental	55	4.87	.34	
The learning environment was non-threatening	Control	40	4.83	.45	.58
	Experimental	55	4.87	.39	
The hands-on practice was beneficial	Control	40	4.85	.36	.28
	Experimental	55	4.93	.33	
EvalOverallAverage	Control	40	4.71	.30	.02
	Experimental	55	4.85	.27	

IX. Limitations

This study had a few limitations which included the following:

1. The participants may not have performed as well as they would have during a required certification or in an actual arrest situation.
2. The sample size was probably too small to detect statistical differences.
3. Test performance anxiety was not measured.
4. The volunteer convenience sample is another limitation to this study.
5. The design of the performance checklists was assessed to be pass or fail, and this nominal data scale limited us in statistical strategies.

X. Conclusions and Implications

There were not any statistically significant differences found between the two groups. In other words, the educational intervention (First Responder Course) did not result in significantly higher pass rates for the experimental group, nor did it increase confidence or reduce anxiety regarding CPR or use of the AED (Lifepak12).

No external or internal factors could be confirmed as contributing to this lack of positive results. Some of the factors examined as potentially confounding variables were:

1. Resuscitation knowledge and experience prior to entering the study.
2. Other demographic variables such as BLS instructor, years as a nurse, number of codes attended, etc.
3. Knowledge and experience gained between pre and post tests was tracked but was not significant. Here are a few examples:
   a. Number of codes participated in
   b. Number of mock codes participated in
   c. Formal classes or reviews
   d. Checking the crash cart
   e. ACLS course
4. Other factors that could not be measured involved changes in institutional approach to CPR/ resuscitation training which occurred during data collection such as:
   a. Changes in BAMC's orientation to include the Lifepak 12
   b. Expanded mock code program
   c. Stronger focus on Lifepak 12/ AED training in BLS course
   d. Mandatory hands on AED testing

Nursing research involving retention of skills is a relatively new area of investigation. There is no "state-of-the-science" methodology or template of successful design available to assist in the conduct of this inquiry. Recommendations from these research results are as follows:

1. Replication of this study with a larger sample size, more controls for incidental training, better approach to assessing confidence and anxiety. Also, more rigor in BLS data collection tools.
2. Further research is needed in order to help identify the most appropriate training and education concepts to facilitate retention of skill.
3. Standardized performance checklists that describe the sequential nature of BCLS need to be developed and utilized.

XI. Significance of Research to Military Nursing

A brief updated literature review showed no studies related to registered nurses resuscitation skills in the military nursing literature. The value of this research is that one-on-one training is very expensive because of the student:instructor ratio. This research suggests that for BLS skills review, the additional expense of one-on-one training is not warranted. Knowing this will decrease the likelihood of pursuing this teaching strategy, thus saving hospital education departments training costs.

XII. References

American Heart Association (2003). http://www.americanheart.org/presenter.jhtml?identifier=3012127

Army Nurse Corps Professional Development and Readiness Guide (2000). Available at http://armynursecorps.amedd.army.mil/pdrg-2000.pdf

Aufderheide, T.P., & Stapleton, E.R. (Eds)(2000). Instructor's Manual: Basic Life Support. American Heart Association.

Bassi, S. Albizzati, M.G., Ferrarese, C., Frattola, L., Cesana, B., Piolti, R. & Farolfi, A. (1989). Alpidem, A novel anziolytic drug. A double-blind, placebo-controlled study in anxious outpatients. *Clinical Neuropharmacology*, 12, 67-74.

Brown, J., Heeter, L.M., Marinelli, A., Rex, E., Reynolds, L. (1995). The first 3 minutes: Code preparation for the staff nurse. *Orthopedic Nursing,* 14(3), 35-40.

Chehardy, P., Dohery, A., Dracup, K., Handley, A., Hawkins, H., Juarbe, T., Kloeck, W., Lynch, B., Mancini, M.B., Mason, P., Palmer, E.L., Stapleton, E.R., Terndrup, T.E., & Wilson, E. (2001). Education. *Annals of Emergency Medicine, 37*(4), 1-18.

Cline, M.E., Herman, J., Shaw, E.R., & Morton, R.D. (1992). Methodology Corner: Standardization of the Visual Analog Scale. *Nursing Research*, 41, 378-380.

Coady, E.M. (1999). A Strategy for nurse defibrillation in general wards. *Resuscitation, 42*, 183-186.

Curry, L. & Gass, D.A. (1987). Effects of training in cardiopulmonary resuscitation on competence and patient outcome. *Canadian Medical Association Journal, 137,* 491-496.

FM7-0 Training the Force. (2002). Available at http://www.adtdl.dll/fm/7-0/fm7-0.htm

Grundy, S.E. (1993). The confidence scale: Development and psychometric characteristics. *Nurse Educator, 18*, 6-9.

International Liaison Committee on Resuscitation (ILCOR). (2000). Guidelines 2000 for Cardiopulmonary Resusciation and Emergency Cardiovascular Care: An International Consensus on Science. American Heart Association.

JCAHO Standards (2004). Provision of Care, Treatment, and Services. Standard PC.9.30. Available at http://www.jcaho.org/

Kaye, W. (1995). Research on ACLS training-which methods improve skill and knowledge retention? *Respiratory Care, 40*(5), 538-549.

Knowles, M. (1975). Self-Directed Learning. Chicago: Follet.

Lee, K.A. & Kieckhefer, G.M. (1989). TECHNICAL NOTES: Measuring human responses using Visual Analog Scales. Western Journal of Nursing Research, 11, 128-132.

Mager, R. (1975). Preparing Instructional Objectives (2nd ed). Belmont, CA: Lake Publishing Co.

Smith, Kimberly K. (2004). Evaluation of Staff's Retention of ACLS and BLS Skills. TSNRP Final Report.

TC8-800, Semi-Annual Combat Medic Skills Validation Test. (2000). Available at https://hosta.atsc.eustis.army.mil/cgi-bin/atdl.dll/tc/8-800/tc8-800.htm

XIII. Outcomes Resulting From Study

Publications

Journal, Authors: COL Kimberly Smith, Dr. Darlene Gilcreast, Ms. Karen Pierce, Title: Evaluation of Staff's Retention of ACLS and BLS Skills, *Resuscitation,* acceptance notification received 13 February 2008.

Presentations

1. 14th Biennial Phyllis J. Verhonick Nursing Research Course poster session at the 110th Annual Meeting of the Association of Military Surgeons of the United States (AMSUS), San Antonio, Texas. 8-11 May 2006. Author: LTC Kimberly K. Smith.

2. Sigma Theta Tau Research and Scholarship Conference at The University of the Incarnate Word, 10 January 2007, San Antonio, TX. Author: LTC Kimberly K. Smith. Presenter: Ms. Karen Pierce

3. 15th Biennial Phyllis J. Verhonick Nursing Research Course poster session at the 111th Annual Meeting of the Association of Military Surgeons of the United States (AMSUS), San Antonio, Texas. 12-15 May 2008. Author: COL Kimberly K. Smith.

4. Effect of First Responder Training on BLS Skills, Pacific Institute of Nursing 2009 Conference: Advancing Practice, Education and Research, Waikiki Beach, Oahu, HI, MAR 2009. Author and presentor COL Kimberly K. Smith